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wtf: killing gametes for for more than 110 million years

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wtf: Killing gametes for more than 110 million years

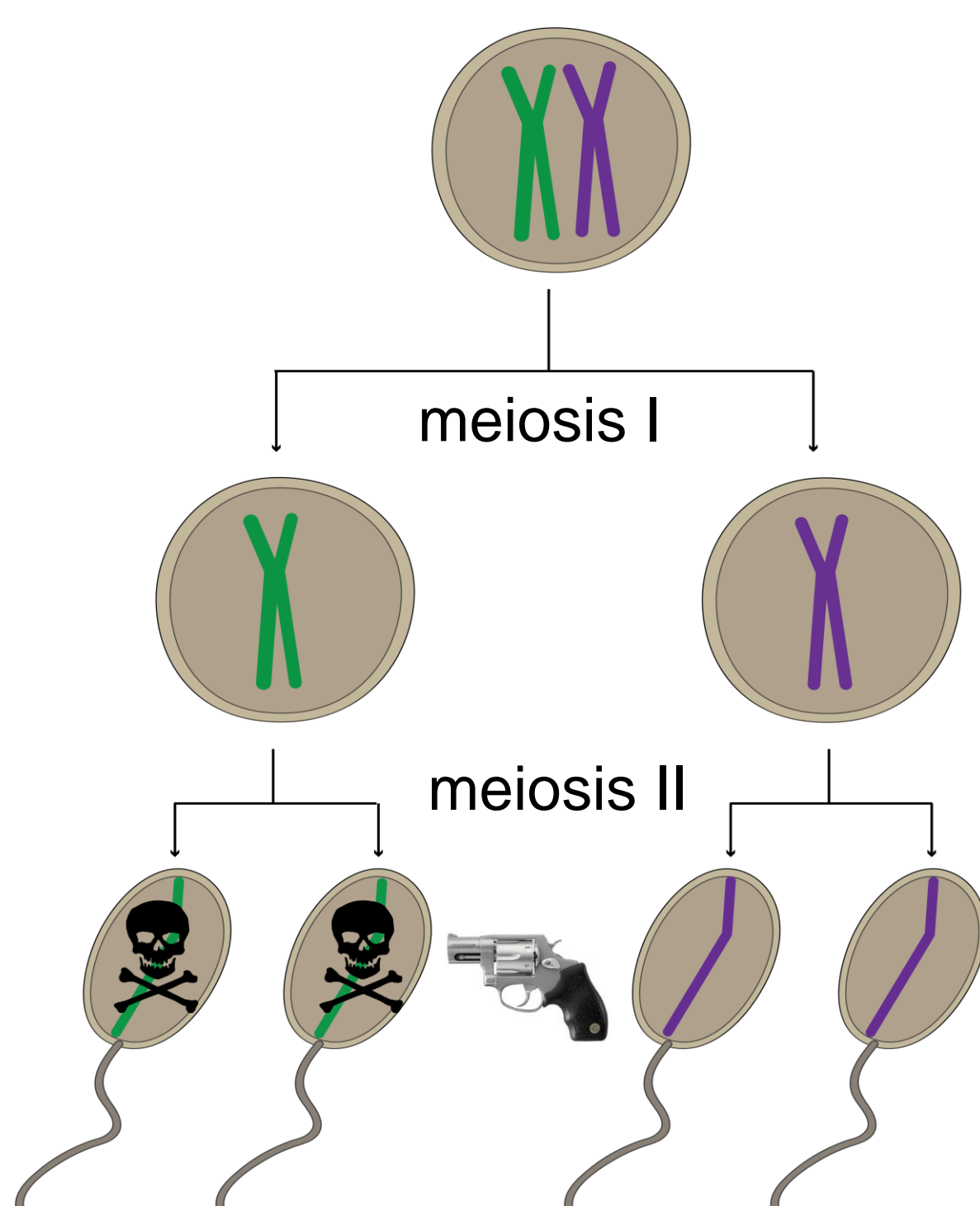
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STOWERS INSTITUTE[®]
FOR MEDICAL RESEARCH

Meiotic drivers break Mendel's law of segregation



- Increase their own transmission into the next generation (up to 100%)
- Can decrease fertility
- Are found throughout eukaryotes:

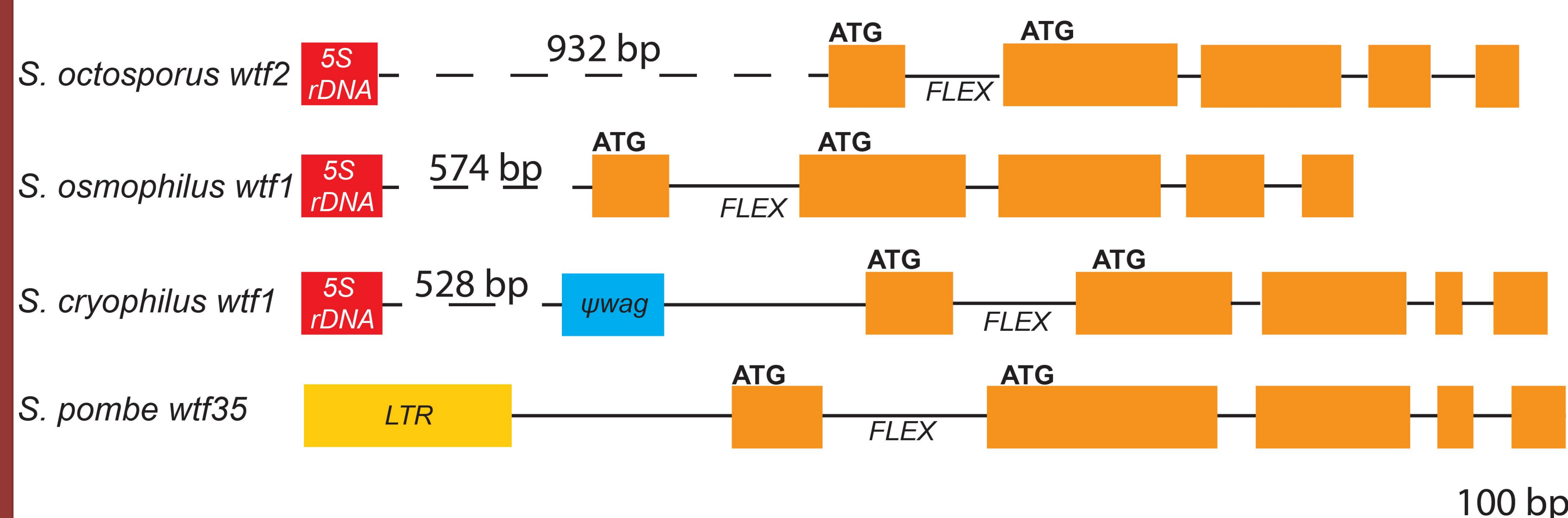
SD in *Drosophila melanogaster*

t-haplotype in *Mus musculus*

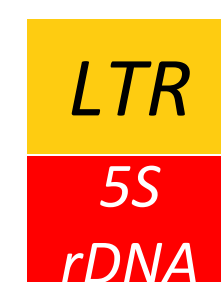
Spok in *Podospira anserina*

Sa in *Oryza sativa*

S. octosporus, *S. osmophilus* and *S. cryophilus* wtf genes share features with *S. pombe* meiotic drivers

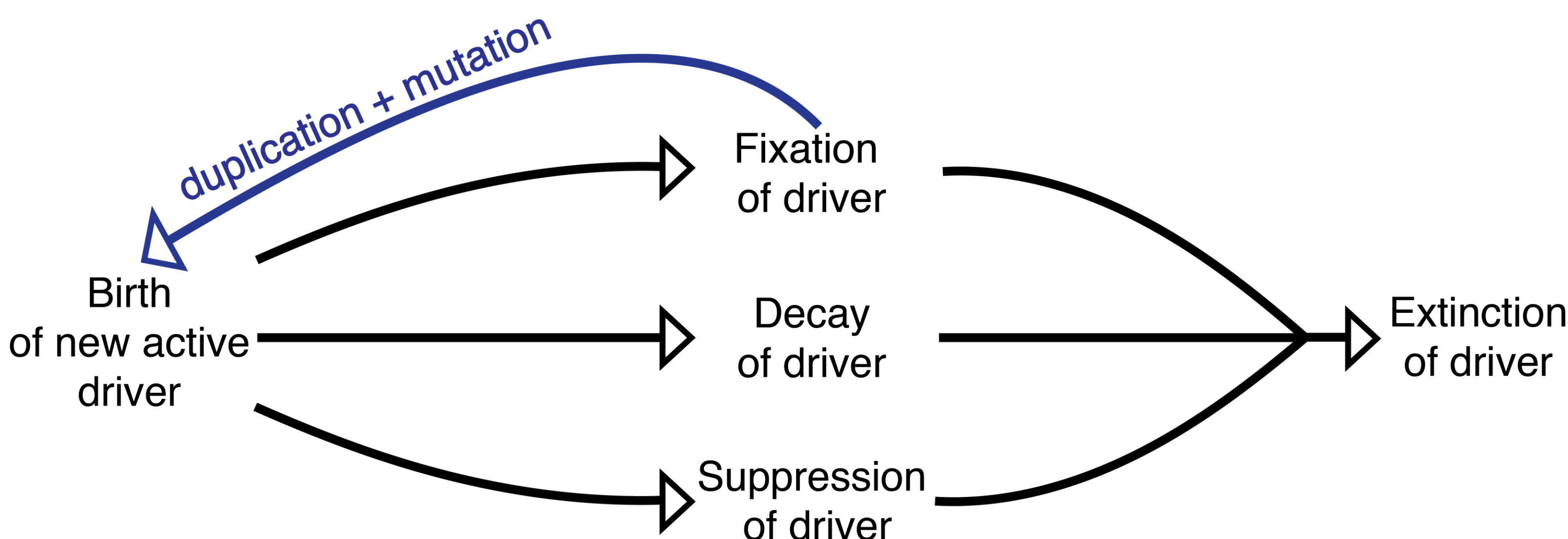


FLEX = Binding site of transcription factor Mei4 that controls poison transcription



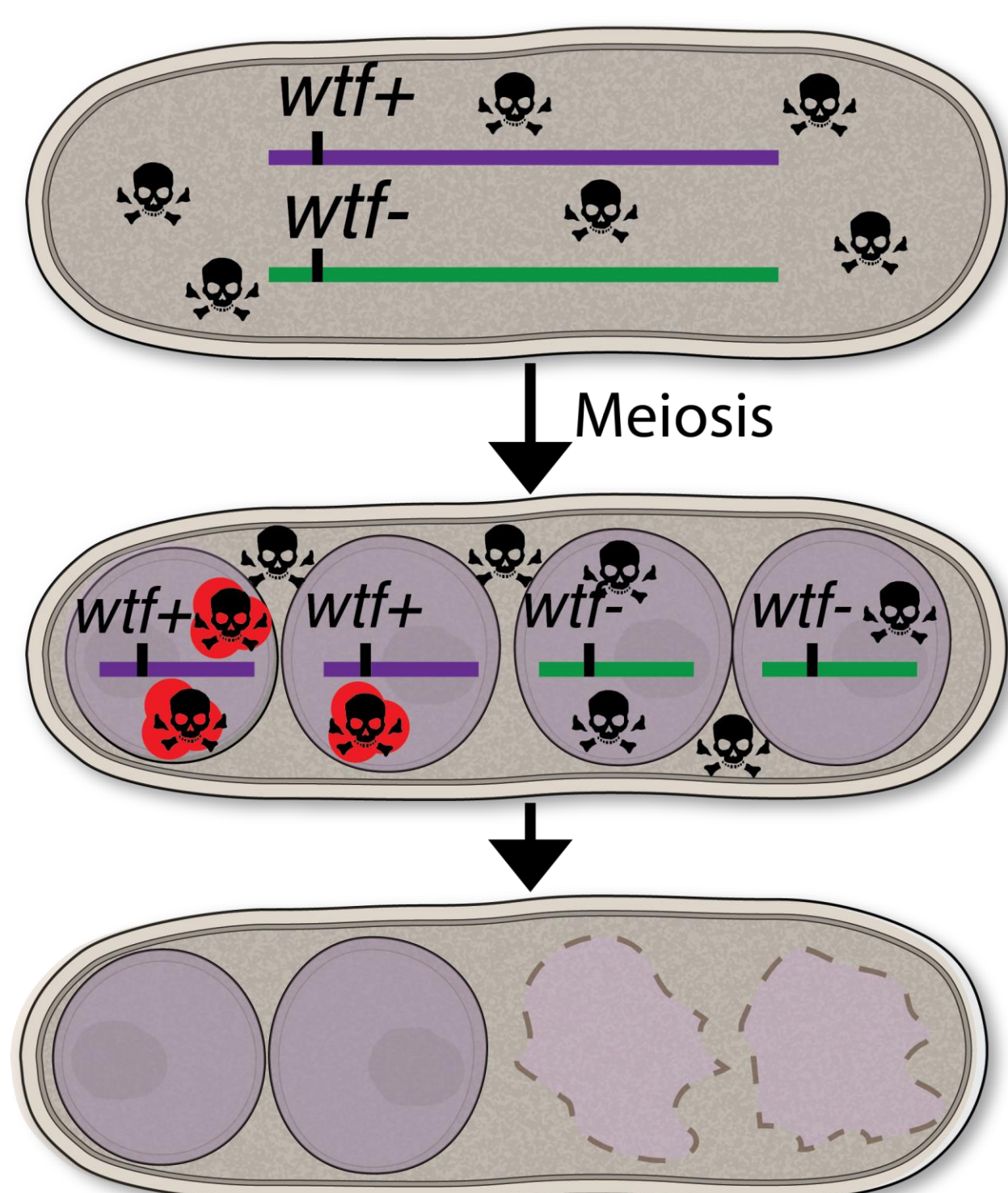
dispersed repetitive sequences pseudogene wtf associated gene

Model for meiotic drive evolution



- Meiotic drivers are predicted to have a short evolutionary lifespan
- Duplication events and mutation could allow meiotic drivers to persist

wtf gene are meiotic drivers in *S. pombe*

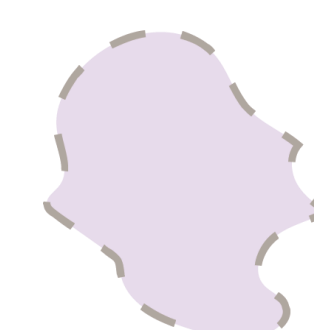


antidote • *wtf* (*with transposon fission yeast*)



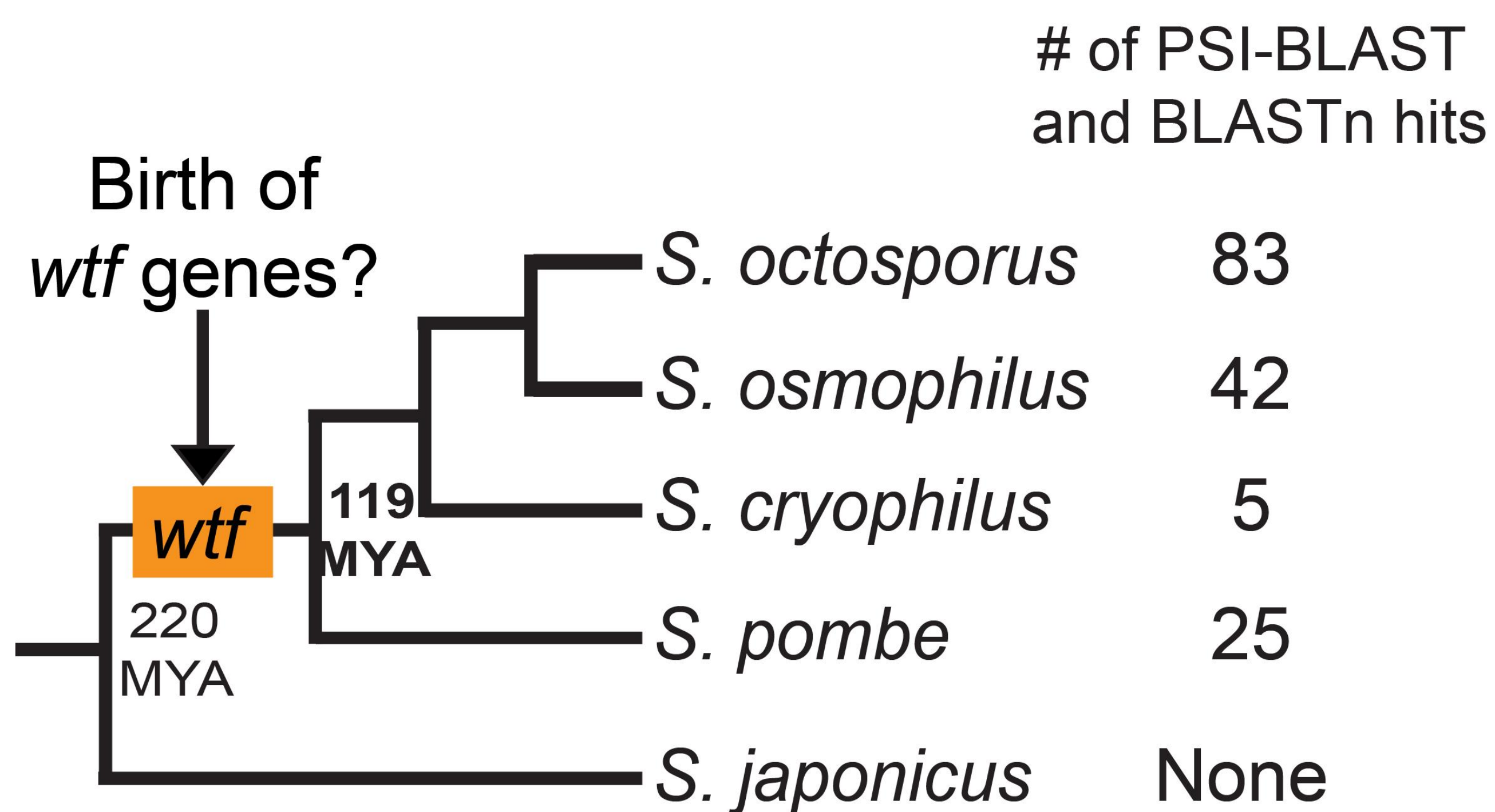
poison

- 1 gene encodes two proteins
- poison spreads to all gametes
- antidote is gamete-specific
- drive facilitates spread of wtf allele in a population



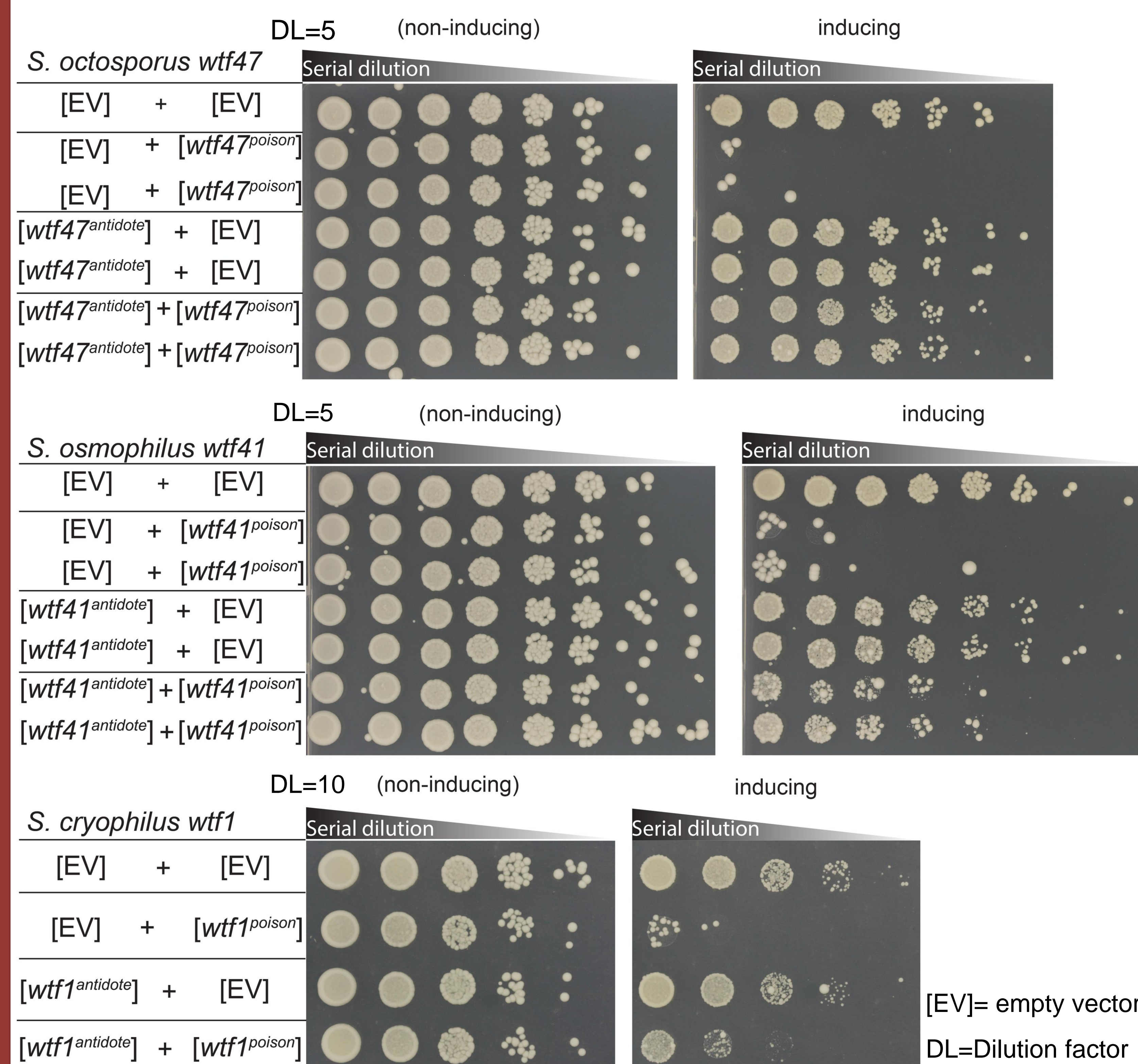
dead gamete

Phylogenetic analysis suggests wtf genes are 110 million years old



wtf genes encodes poison and antidote proteins

Testing ability of *S. octosporus*, *S. osmophilus* and *S. cryophilus* wtf genes to encode poison and antidote proteins by expressing them in budding yeast.



[EV]= empty vector

DL=Dilution factor

Conclusions

- wtf genes are present in *S. octosporus*, *S. osmophilus*, *S. cryophilus* and *S. pombe*
- wtf genes are associated with dispersed repetitive sequences which may allow them to duplicate in the genome by gene conversion
- wtf genes of the four species encode poison and antidote proteins
- *S. octosporus* wtf gene cause meiotic drive in *S. octosporus* (Li-Lin Du lab)
- wtf genes have been meiotic drivers for at least 110 million years

References: Nuckolls and Bravo Núñez et al. (2017); Hu et al. (2017), Rhind et al. (2011)

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